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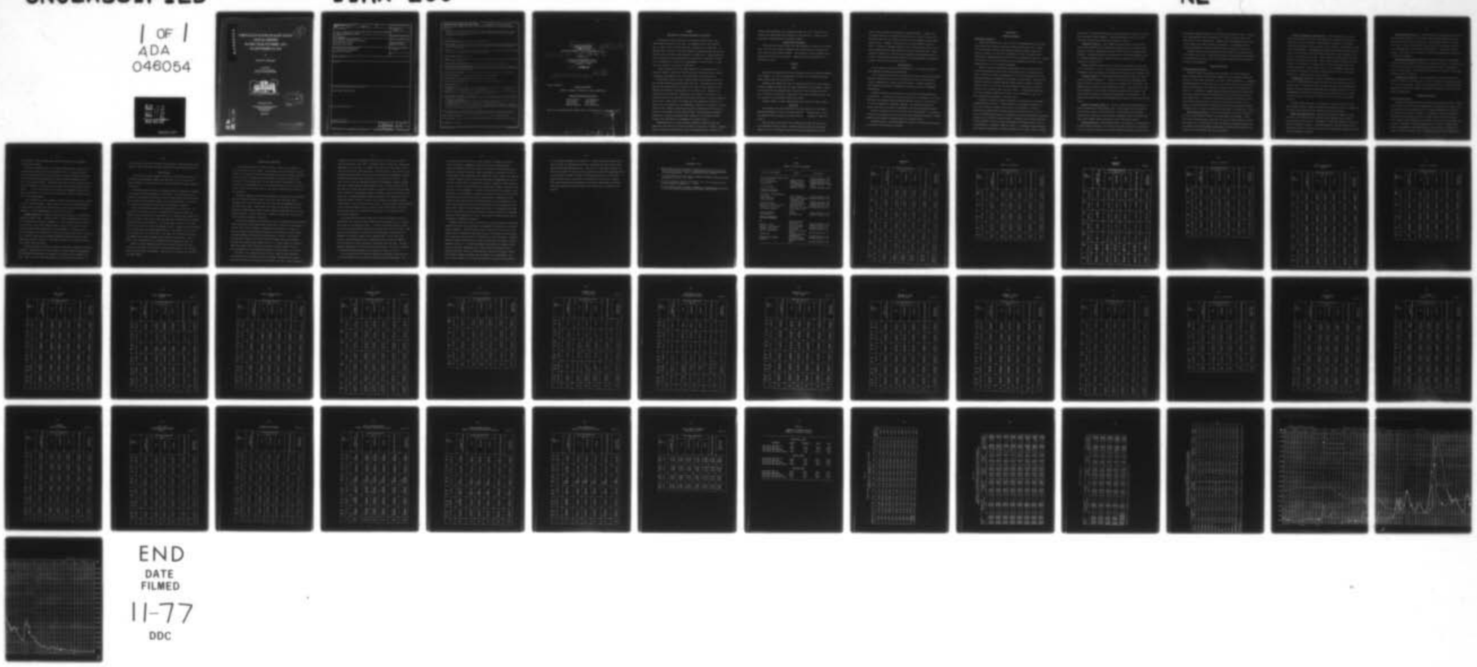

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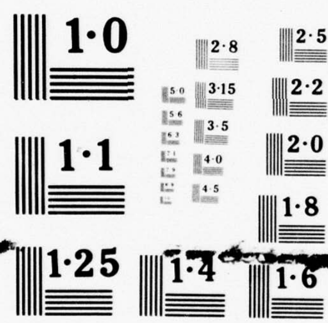
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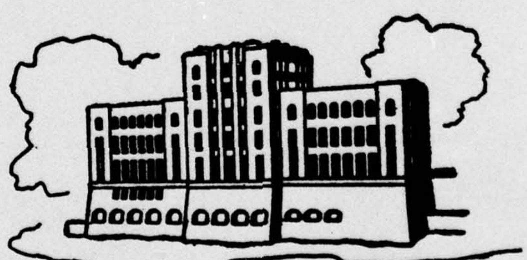
CORALVILLE WATER QUALITY STUDY
ANNUAL REPORT
WATER YEAR OCTOBER 1, 1975
TO SEPTEMBER 30, 1976

by

Donald B. McDonald

sponsored by

U.S. Army Corps of Engineers
Contract No. DACW25-76-C-0056



IIHR Report No. 200

Iowa Institute of Hydraulic Research
The University of Iowa
Iowa City, Iowa

March 1977

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(6) CORALVILLE RESERVOIR
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ANNUAL REPORT

WATER YEAR OCTOBER 1, 1975 TO SEPTEMBER 30, 1976

(9) Annual rept. 1 Oct 75-30 Sep 76,

Submitted by

(10) Donald B. McDonald, Professor
Division of Energy Engineering
University of Iowa

(11) 1 March 1, 1977

(12) 55p.

(15) DACW25-76-C-0056

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Data for plotting hydrological graph (Plate 1) furnished by U.S. Geological Survey.

GENERAL

Description of the Area and Scope of the Project

The Coralville flood control dam is located in Johnson County, Iowa, about three miles north of Iowa City. At conservation pool level, 680 feet msl, it forms a lake 21.7 miles long with a surface area of 4,900 acres. At spillway level, 712 feet msl the lake extends 35.1 miles upstream from the dam. Surface area of the lake at this elevation is 24,800 acres. During a period in the late winter and early spring the level of the pool is reduced to 670 feet msl in anticipation of the use of the impoundment for flood control. At this level the reservoir has an area of 1,820 acres.

Surveys conducted in 1974 and 1975 indicate that at spillway level (712 feet msl) reservoir capacity is 469,400 acre feet; 40,300 acre feet at conservation pool level (680 feet msl); and 10,600 acre feet at 670 feet msl.

The purpose of the Coralville Reservoir Water Quality Project was initiated in 1964 and has continued without interruption since that time. The purpose of the study has been the determination of the effects of a flood control reservoir on the chemical and biological characteristics of its parent river. Samples were collected from the Iowa River upstream from the reservoir; from the top, mid-depth and bottom of the reservoir and from the Iowa River at two points downstream from the dam. From October 1975 through July 1976 samples were collected on a weekly basis and analyzed only for temperature, conductivity, turbidity, dissolved oxygen and pH. Plankton analyses were carried out monthly while all other parameters were determined on a twice monthly basis. During August and September samples were collected and analyzed twice monthly for all parameters except plankton which continued to be enumerated on a monthly basis.

Determinations of pH, carbon dioxide, alkalinity, dissolved oxygen and temperature were made in the field at the time of collection. Turbidity, phosphate, ammonia nitrogen, nitrate nitrogen, total and suspended solids, threshold odor,

five-day 20°C biochemical oxygen demand and total and fecal coliform and fecal streptococcus populations were determined in the laboratory. Plankton counts were made to determine genera and numbers present.

Administrative and Fiscal

The project was continued under the same arrangement as during the preceding year. The U.S. Army, Corps of Engineers, Rock Island District, furnished the major portion of the financial support. The University of Iowa furnished the remainder of the funds for the project. Laboratory space was furnished by the University of Iowa.

METHODS

Field

Routine water samples were collected throughout the year utilizing a Kemmerer water sampler. All reservoir samples were collected from the Mehaffey Bridge, about 6½ miles above the Coralville Dam.

Upstream river samples were taken at Johnson County Road "O" except during periods of high water when they were taken at Highway 220 at South Amana. Samples of the outflow for the reservoir were collected from the Iowa River about one mile below the Coralville Dam. Samples were also taken throughout the year from the Iowa River at the University Water Plant intake.

Sediment samples for heavy metal analysis were taken with a Ponar dredge.

Laboratory

All laboratory work was performed in the water laboratory of the Energy Engineering Division, located in the University Water Treatment Plant. All of the chemical tests were made in accordance with Standard Methods[1] or EPA[2] procedures.

Total and fecal coliform and fecal streptococcus counts were made by use of the Millipore Filter procedure. Plankton counts were made on centrifuged samples by use of the Whipple micrometer disc and the Sedgwick-Rafter slide.

Both of these procedures are described in Standard Methods. A sample of uncentrifuged water was also examined from each site in order to include those blue-green algae that are lighter than water and are eliminated by the centrifuging process. A summary of methods used in routine analysis is given in Table 1. Analysis of sediment samples for heavy metals was carried out on digested samples which were then analyzed on an atomic absorption unit. Determination of pesticides in fish and bottom sediments was instituted in the fall of 1976, utilizing extraction procedures and gas chromatographic techniques described in the Pesticide Analytical Manual.

Quality Control

Quality control procedures were implemented for all laboratory analysis, field sampling techniques and data handling.

All biological procedures were performed in accordance with Standard Methods. Bacterial analyses were carried out utilizing sterilized collection bottles, sterile, disposable petri dishes and quality medias. Incubator temperatures were routinely monitored with thermometers with National Bureau of Standards certification.

Chemical procedures were performed in accordancewith Standard Methods or EPA procedures. Standards were run within the matrix of the samples at all times. The bulk of the reagents used were American Chemical Society certified quality or top line reagents from reputable companies. All instruments involved in analysis were part of an annual or semi-annual preventive maintenance program.

Physical analyses were run in accordance with Standard Methods. Instruments utilized in the analysis were part of the preventive maintenance program. Residue weights were determined on balances which are calibrated yearly.

Sampling procedure included preservation and/or any required special handling as directed in the EPA Manual of Methods.

OBSERVATIONS

Physical Conditions

Hydrological (Plate 1):

During the 1975-1976 water year flow into the impoundment was below normal resulting in lower reservoir stage and relatively stable pool level. During the fall and winter months inflow remained relatively constant ranging from 165 cfs on January 13 to 1030 cfs on November 30. Runoff increased in mid-February and a maximum spring flow of 15,700 cfs was reported on April 24. During the remainder of the water year flows into the impoundment were below normal. Minimum flows of 112 cfs occurred in September.

Reservoir level increased slowly during October from ca. 682 to 683 feet msl and was maintained at that level until December when it was gradually reduced to 680 feet msl where it remained until the level was reduced to 670 feet msl during February in preparation for storage of spring runoff. Relatively low rainfall and runoff from March through mid-April made it possible to maintain reservoir level at ca. 670 feet msl until storage of excess flows caused the reservoir level to peak at 694.5 feet msl on May 2. Following this peak reservoir level declined to 680 feet msl by May 24, and remained at or near this level throughout the remainder of the water year.

Discharge from the dam remained relatively low during October and November ranging from 160 to 350 cfs. Increased inflow in late November resulted in a short term increase in release rates in early to mid-December to 1800 cfs. Following this period flows were again reduced and varied from 150 to 470 cfs until late January when periods of precipitation and runoff necessitated increasing release rates to 1200 cfs in early February. Discharge rates fluctuated throughout the remainder of the late winter and spring period ranging from ca. 300 cfs in mid-February to a maximum of 7000 cfs on May 1. Following this peak discharge rates exhibited considerable fluctuation ranging from ca. 1200 to 4500 cfs during

May and June. Discharge declined during July and August and remained at 150 cfs from late August through September. Detailed hydrological data for the Iowa River and the Coralville Reservoir are presented in Plate 1.

Temperature (Table 2): Water temperatures were taken on a weekly basis from October through July and followed the seasonal pattern of previous years. River and reservoir temperatures were above 20°C from early June through mid-September. A maximum upstream river temperature of 27.9°C was observed on July 12. Maximum downstream river temperature was also observed on July 12 when temperatures reached 27.0°C.

Maximum reservoir temperatures of 27.5°C were also observed at the surface of the impoundment on July 12. Some thermal stratification was observed in the impoundment in July and August but temperature differentials never exceeded 3.6°C.

Turbidity (Table 3): Turbidity determinations were also made on a weekly basis from October through July. Turbidity values above the impoundment were generally lower than those of the previous year ranging from 3 to 900 NTU. The highest values occurred in early December and in March. A maximum value of 600 JTU was observed in the reservoir during March while turbidity values of less than 10 NTU were frequently observed from mid-November to mid-February. Turbidity values within and below the impoundment were generally lower than upstream values.

Specific Conductance (Table 4): Specific conductance determinations were conducted weekly from October through July. Values ranged from 326 μmho/cm in the reservoir in March to 899 μmho/cm above the impoundment in mid-January. Lowest specific conductance values usually accompanied periods of snow melt and runoff while highest values accompanied cold low flow winter periods.

Solids (Tables 5-7): High suspended solids concentrations are characteristic of heavy runoff, particularly from agricultural lands, and due to the relatively low flow during the present year were less frequently observed in the river and

the reservoir following snow melt or rainfall than in some prior years. Maximum total and suspended solids concentrations of 2,429 and 736 mg/l respectively were observed in the upstream river. Maximum total and suspended solids levels in the reservoir were 868 and 686 mg/l respectively. Low suspended solids levels were observed in the river and the reservoir during the winter period.

Highest dissolved solids concentrations were present in the upstream river in the winter and in June. During the 1976 water year total solids concentration at the University Water Plant were not consistently higher than those observed just below the impoundment.

Chemical Conditions

Dissolved Oxygen (Table 8):

Dissolved oxygen concentrations were determined on a weekly basis from October through July and were generally highest from late December through mid-March due to the greater solubility of the gas at lower temperatures. In addition, high photosynthetic activity under the ice in January resulted in extremely high oxygen concentrations in the reservoir, reaching 31.8 mg/l (222% saturation) on January 5. No significant oxygen depletion was noted during early spring runoff and oxygen concentrations never dropped below 8.9 mg/l during the late winter-early spring period. Intermittent stratification resulted in reduction in dissolved oxygen concentrations at the bottom of the reservoir during July and August but stratification was transitory and the effects were generally minimal. A minimum value of 0.3 mg/l was observed at the bottom of the reservoir on July 12.

Carbon Dioxide (Table 9): Free carbon dioxide was consistently present in the river during February and March and during August and September. Carbon dioxide was frequently absent during the fall and early winter months, and from May through July. Carbon dioxide levels were highest in February and March and from August through mid-September when maximum concentrations of 12 mg/l were observed in both the upstream river and the reservoir.

<u>Alkalinity, Hardness, pH (Tables 10-14)</u>: These three factors are interrelated and influenced by climatic and hydrological conditions as well as the activities of aquatic organisms. Phenolphthalein alkalinity was constantly lower than during the previous two years and was inversely proportional to carbon dioxide concentrations. Phenolphthalein alkalinity was usually present from late October to early January and from mid-May through mid-July but was generally absent for the remainder of the year. Highest hardness concentrations occurred in February, late March, May and June. Lowest values occurred in October and from mid-July to mid-September. Determinations of pH were conducted weekly from October through July. Values ranged from 7.3 to 9.3 Maximum pH occurred in late October and November and in early January during a period of high algal productivity. Minimum values occurred in August.

<u>Orthophosphate (Table 15)</u>: Average orthophosphate concentrations in the river and the impoundment were generally lower than those observed during the previous year. As in previous years, concentrations above the impoundment were generally slightly higher than downstream values ranging from 0.02 to 0.5 mg/l. Orthophosphate concentrations were generally less than 0.15 mg/l in all areas, and concentrations at reservoir and downstream river stations never exceeded 0.37 mg/l.

Phosphate levels appeared to be influenced by rainfall and runoff rather than seasonal patterns. Maximum concentrations frequently occurred in conjunction with runoff while minimum values occurred during low flow periods.

<u>Ammonia Nitrogen (Table 16)</u>: Maximum concentrations of ammonia nitrogen occurred at all locations during early March while minimum values occurred during mid-April and late June. A maximum of 1.18 mg/l was observed in the river below the reservoir on March 1. With the exception of the high values in March and the low levels in early April and late June, concentrations remained relatively constant throughout the period.

Nitrate Nitrogen (Table 17): Nitrate nitrogen concentrations were generally lower than those observed in the previous year although extremely high levels persisted from mid-February through June. Values ranged from 0.01 in October to 9.5 mg/l in June. Concentrations above 2.0 mg/l were consistently observed at all sampling points from February through mid-July. Low nitrate nitrogen levels of less than 1 mg/l were present in October and November and during much of August and September.

Biochemical Oxygen Demand (Table 18): Average biochemical oxygen demand values were slightly higher than those of the previous two years. A maximum value of 11.6 mg/l occurred at the upstream river station on March 1, probably as a result of spring runoff. Increases in BOD values due to the death of large algal populations were not observed.

Threshold Odor (Table 19): Average threshold odor values were generally similar to those of the previous year. Levels were highest in August when values of 7.5 to 32 were measured. Lowest values occurred in the fall and winter months. Threshold odor values were similar in upstream and downstream river stations and within the impoundment.

Biological Conditions

Bacteria (Tables 20-22):

Largest total coliform populations frequently coincided with runoff. Highest counts usually occurred above the impoundment, but populations were smaller than in previous years and a maximum count of 127,000 organisms/100 ml occurred at the bottom of the reservoir on March 15. A maximum of 72,000 organisms/100 ml occurred above the reservoir on June 14 during a period of high river stage. Total coliform counts downstream were constantly lower than at the upstream river location. A maximum of 41,000 organisms/100 ml was present in samples taken below the impoundment at the University Water Plant on March 1, probably as a result of inflow from Clear Creek, a tributary of the Iowa River downstream of

the reservoir. Total coliform populations were lowest from late December through early February.

High fecal coliform levels (ca. 22,000 organisms/100 ml) occurred in the upstream river during periods of high runoff in June. In general, however, fecal coliform levels were low in all samples and reservoir samples frequently contained less than 10 organisms/100 ml during October and November and from early July through September. During the 1976 water year fecal coliform levels directly downstream of the dam were only slightly higher than reservoir levels. However, counts at the University of Iowa Water Plant sampling site were frequently higher than at the site directly upstream, due likely to input from the Clear Creek drainage basin.

Fecal streptococcus levels generally exhibited fluctuations similar to those of fecal coliform organisms. Values ranged from less than 10 organisms/100 ml in many reservoir samples from October through January and from July through September to 22,300 organisms/100 ml in the river on June 14.

Plankton (Table 23): Plankton populations were sampled on a monthly basis during the present study. A maximum count of 79,940 organisms/ml was observed in the upstream river sample on November 10. Plankton populations were greater in the reservoir than those observed during the past two years and levels frequently exceeded 10,000 organisms/ml in the impoundment. A maximum count of 32,640 organisms/ml was observed in a reservoir mid-depth sample taken on January 5. The relatively large reservoir plankton populations observed during the summer months were probably the result of the stable reservoir level resulting from the low rainfall during the period.

Plankton diversity was generally greatest from October to December and during September. Lowest diversity occurred in March. Diatoms, especially Cyclotella and unidentified flagellates, were generally the dominant forms throughout the year. Green algae were relatively common in the fall and early winter but de-

clined during the late winter and early spring months. Blue-green algae did not appear in samples until April and were uncommon during the 1976 summer period.

OTHER STUDIES

In addition to the water quality studies of the Coralville Reservoir and Iowa River, bottom sediment samples were taken from all river and reservoir sites on February 2, May 10 and July 26, 1976 and analyzed for copper, chromium, lead and zinc.

Metal analysis was carried out on sediment samples by digestion of weighed, dried aliquot, using EPA methods for total methods. The digested sample was liquified, concentrated and extracted and was analyzed with an atomic absorption unit utilizing the microthermal atomizer for greater sensitivity. All values were reported as micrograms per gram (μg/g) dried weight of sediment.

During the 1976 studies copper values ranged from 6.0 to 28.0 μg/g. Consistently lower values are seen at the Highway 218 sampling site while the highest values were observed at the reservoir site. Chromium values ranged from 8.0 to 34.0 μg/g. Again, lower values were observed at Highway 218 while highest values were found in the reservoir. Lead values ranged from 16 to 432.0 μg/g with lowest values occurrring at the Highway 218 site. Highest lead concentrations were observed during the summer sampling period at the Highway "O" site. Zinc levels ranged from 12.0 to 102.0 μg/g. Once again, the low values were seen at the Highway 218 site while highest values occurred in the reservoir. The results of the 1976 sediment metal determinations are summarized in Table 24.

Samples of bottom sediments and fish for pesticide analysis were first collected in September but the results of these analyses were not yet available when the current report was prepared. These data will be presented in the 1976-1977 Annual Report.

DISCUSSION AND CONCLUSIONS

Data obtained during the present water year continue to be consistent with the results of prior studies. As in previous years the limnology and water quality of the Iowa River and Coralville Reservoir have been influenced primarily by four factors: (1) non-point source pollution resulting from agricultural activities in the drainage basin; (2) the hydrological characteristics of the Iowa River; (3) the morphometry of the Coralville Reservoir; and (4) the fluctuations in the storage and pool level of the reservoir resulting from flood control operation.

During the present water year the significance of non-point source pollution and the hydrological characteristics of the river were especially evident. Throughout most of the 1976 water year river flow into the impoundment was substantially below normal. Mean annual flow during the 1976 water year was the lowest since 1968 and mean monthly flows for August and September were the lowest during the period of record (1956-1976). Monthly and annual mean flows for the last 10 years are summarized in Table 25.

During low flow periods concentrations of several parameters were substantially lower than levels observed during high flow periods. These effects were usually evident in the case of turbidity, suspended solids, phosphates, nitrates and bacterial populations which generally peaked at the beginning of runoff periods and showed minimal levels during extended periods of low flow. This pattern was especially evident in the case of nitrate nitrogen values which exhibited extremely high concentrations ranging from 2.7 to 9.5 mg/l during the relatively high flow months of April through June and then declined steadily from July through September as river discharges decreased to minimum values of 0.10 mg/l.

The effect of an extended period of low river flows on water quality becomes apparent when comparisons are made of average concentrations of various parameters during years with high,low and average river flows. Table 26 presents

a summary of mean river discharge for the Iowa River at Marengo, Iowa during three selected water years; 1973, a relatively high flow year with a mean annual discharge of 3773 cfs; 1971, an "average" water year with a mean annual flow of 1792; and the current (1976) water year, a low flow period. Data relative to the average monthly and annual values of several parameters (orthophosphate, ammonia nitrogen, turbidity and total coliforms) are also given in this table. In the case of three of the four parameters compared (orthophosphate, ammonia nitrogen and total coliform bacteria) average annual values for these parameters at the upstream river station were lowest during the current "low flow" water year while total coliform and orthophosphate values were highest during the 1973 "high flow" water year. The average ammonia nitrogen concentration was substantially lower during the current "low flow" year but little difference was observed between concentrations in the 1971 and 1973 water years. Average turbidity values exhibited little variation between years but it must be kept in mind that the soil loss during a high flow year is substantially greater due to the greater volume of water passing downstream.

Low inflow and the resultant stable pool level were probably in part responsible for the relatively large plankton populations observed in the impoundment during the June-September period. A similar relationship between constant pool level and large plankton populations has been observed in prior years. Large plankton populations were also observed in the impoundment during August and September of 1975 when reservoir level remained stable. On the other hand, reservoir plankton populations were considerably smaller during the summer of 1974 when high river inflow resulted in fluctuating reservoir level. The high plankton populations in the reservoir during the summer of 1976 also contributed to increased downstream plankton levels which were largest since 1972.

As in previous years the Coralville Reservoir contributed to the reduction of certain parameters in the Iowa River directly below the impoundment. This

was especially true in the case of total coliforms, turbidity and plankton. Lesser reductions in phosphate and BOD values were also observed while ammonia and threshold odor values showed no consistent differences between upstream and downstream locations. These comparisons are summarized in Table 27. Although heavy metal analyses were not carried out on water samples, the analysis of sediment samples from the river above and below the impoundment and from the reservoir indicate that the reservoir is acting as a "sink" for these materials and that in most cases concentrations are substantially higher in reservoir sediments than in river sediments. In addition, precipitation and settling of these substances in the impoundment has generally reduced the level in the river sediments directly below the dam but metal concentrations in sediments from the University Water Plant station are frequently equal to and occasionally exceed levels at the upstream river station, indicating input of these substances from Clear Creek or runoff from other downstream sources. The possibility that high levels of heavy metals in Coralville Reservoir sediments might lead to biomagnification of these substances by fish or other aquatic organisms has not been investigated but should be considered.

During the 1976 water year concentrations of several parameters occasionally reached levels that could technically be considered violations of the Iowa Water Quality Standards. Dissolved oxygen values in excess of 5.0 mg/l in all river samples but were consistently less than 5.0 mg/l in mid-depth and bottom samples in the reservoir during periods of stratification in July and August. A minimum dissolved oxygen concentration of 0.3 mg/l was observed at the bottom of the impoundment on July 12. Low dissolved oxygen values normally accompany stratification in eutrophic impoundments such as the Coralville Reservoir and it is highly unlikely that these low levels adversely affected the reservoir fishery since adequate oxygen was present near the surface of the impoundment. The water quality standard of 9.0 for pH was equalled or exceeded in the reservoir

on two occasions (November 4 and January 5). In both cases these high pH values were the results of photosynthetic activity associated with algal blooms rather than pollution from upstream sources. Fecal coliform counts were frequently in excess of the limit for primary contact recreational waters (200 organisms/100 ml) and occasionally exceeded the limit of 2000 organisms/100 ml for public water supply raw water source, especially at the upstream river location. However, since these high levels were apparently the result of agricultural land runoff rather than pollution by sewage, they are not technically in violation of the standard.

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1. American Public Health Association, American Water Works Association and Water Pollution Control Federation, Standard Methods for the Examination of Water and Wastewater, 14th Ed. APHA New York, N.Y. (1976)

2. U.S. Environmental Protection Agency, Methods for Chemical Analysis of Water and Wastes, Cincinnati, Ohio (1974).

3. U.S. Dept. of Health, Education and Welfare, Food and Drug Administration, Pesticide Analytical Manual Vol. 1 (1968).

4. U.S. Environmental Protection Agency, Handbook for Analytical Quality Control in Water and Wastewater Laboratories, Cincinnati, Ohio (1972).

Table 1

SUMMARY OF ANALYTICAL METHODS

BIOLOGICAL PROCEDURES	Method	References
Biochemical Oxygen Demand (BOD)		Standard Methods p 546
Fecal Coliforms	Membrane filter	Standard Methods p 937
Fecal Streptococcus	Membrane filter	Standard Methods p 944
Phytoplankton	Centrifugation-Sedgewick-Rafter	Standard Methods p 1018, 1024
Total Coliforms	Membrane filter	Standard Methods p 928
CHEMICAL PROCEDURES		
Alkalinity, phenolphthalein and total	Color titration	Standard Methods p 280
Ammonia Nitrogen	Direct Nesslerization	Standard Methods p 412
Carbon Dioxide	Titrimetric free carbon dioxide	Standard Methods p 298
Dissolved Oxygen	Azide modification	Standard Methods p 443
Hardness, calcium and total	EDTA titration	Standard Methods p 202
Metals, Cr, Cu, Pb, Zn on sediment samples	Digestion, extraction, microthermal atomizer	EPA Manual p 82, 85
Nitrate Nitrogen	Brucine	Standard Methods p 427
Orthophosphate	Ascorbic acid	Standard Methods p 481
PHYSICAL PROCEDURES		
pH	Beckman Expandomatic SS-2	Standard Methods p 460
Residual, total	Dried 103-105^{o}C	Standard Methods p 91
Residue, non-filterable	Dried 103-105^{o}C	Standard Methods p 94
Residue, filterable	Calculated	Standard Methods p 89
Specific Conductance	YSI-31 Conductivity Bridge	Standard Methods p 73
Temperature	Certified Brooklyn thermometers	Standard Methods p 125
Threshold Odor Number	Multiple dilution	Standard Methods p 79
Turbidity	Hach 2100 turbidimeter	Standard Methods p 134

TEMPERATURE
(°C)

Table 2

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Coralville Reservoir No. 2 Mid-Depth	Coralville Reservoir No. 2 Bottom	Iowa River Downstream	University Water Plant
Oct. 6	15.0	15.2	15.2	14.8	16.0	15.6
13	17.4	17.0	16.4	16.4	16.5	17.2
19	12.0	15.4	14.9	14.4	15.3	14.2
27	11.0	13.4	13.2	12.8	13.6	12.4
Nov. 4	14.4	14.4	12.7	12.4	13.6	15.4
10	11.0	12.2	12.2	12.2	13.0	11.8
17	8.4	9.6	9.4	9.4	10.0	10.8
24	2.2	6.2	6.2	6.0	7.0	6.2
Dec. 1	0.3	1.7	1.9	1.9	3.4	2.4
8	1.8	1.8	1.8	2.0	3.0	2.8
15	1.3	0.7	0.6	0.7	2.2	2.4
22	0.6	0.9	1.0	1.0	1.5	0.5
Jan. 5	0.2	1.2	1.2	0.7	1.8	0.7
12	0.8	2.1	3.4	3.2	2.5	5.4
19	0.6	0.9	3.4	3.3	3.2	7.4
26	0.2	0.7	1.2	1.0	3.2	5.9
Feb. 2	0	2.5	2.4	2.4	2.6	1.2
9	1.4	2.2	1.8	1.8	3.6	4.4
16	1.2	1.5	1.4	1.0	2.8	4.4
23	1.4	1.3	1.2	1.2	1.8	2.6
Mar. 1	3.1	2.6	2.7	2.6	4.3	5.2
8	1.6	1.8	---	---	1.6	4.0
15	3.9	4.3	3.8	3.3	4.8	4.9
22	8.5	7.7	7.2	7.4	8.0	9.1
30	9.9	9.6	9.6	9.5	10.5	10.2
Apr. 5	12.4	12.1	11.9	12.0	12.5	13.4
12	12.8	12.3	12.0	11.2	13.2	13.2
19	17.2	16.4	17.0	16.8	18.5	18.0

Table 2 (continued)

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Coralville Reservoir No. 2 Mid-Depth	Coralville Reservoir No. 2 Bottom	Iowa River Downstream	University Water Plant
Apr. 26	----	12.0	11.2	11.2	13.9	13.5
May 3	10.2	12.4	12.4	12.2	12.4	12.0
10	17.6	15.3	14.9	14.7	15.8	15.8
16	16.5	17.1	16.6	16.3	16.6	17.0
24	16.7	17.8	17.7	17.5	18.4	17.8
June 1	19.1	20.6	20.8	20.2	19.9	20.7
8	24.0	----	23.0	22.4	23.2	24.2
14	23.5	24.6	24.6	24.3	24.8	24.2
21	22.8	22.4	22.6	22.2	22.7	22.7
28	24.4	24.6	23.8	23.4	24.0	24.7
July 5	25.2	26.6	23.2	23.0	25.0	24.7
12	27.9	27.5	25.3	25.0	27.0	26.8
21	25.3	26.4	25.5	25.5	26.2	26.9
26	25.2	26.1	25.7	24.7	25.6	26.8
Aug. 9	22.2	23.6	22.8	22.8	24.2	26.0
23	23.8	24.5	22.6	22.9	22.4	24.5
Sep. 13	21.8	21.2	21.4	21.0	20.8	24.1
27	14.8	16.9	16.8	16.8	17.6	19.4

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Table 3

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2			Iowa River Downstream	University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 6	20	16	20	28	22	23
13	26	15	16	23	20	21
19	12	11	12	25	15	17
27	14	13	14	15	10	14
Nov. 4	25	9	9	13	10	12
10	21	13	15	23	15	19
17	19	9	8	8	8	29
24	6	8	8	9	7	19
Dec. 1	900	8	9	9	11	19
8	24	9	10	10	6	9
15	35	15	14	14	5	12
22	6	9	10	10	9	6
Jan. 5	5	6	6	6	5	6
12	22	11	11	11	11	4
19	23	4	4	5	4	3
26	3	3	3	4	3	4
Feb. 2	3	2	2	2	2	2
9	4	4	5	6	3	4
16	21	11	10	11	8	13
23	36	35	36	35	19	16
Mar. 1	600	490	490	500	400	350
8	51	67	---	---	97	300
15	600	500	550	600	320	73
22	89	74	74	90	65	75
30	60	74	64	80	40	37
Apr. 5	60	47	45	50	35	29
12	35	33	33	46	31	31
19	820	65	93	320	48	43

Table 3 (continued)

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Coralville Reservoir No. 2 Mid-Depth	Coralville Reservoir No. 2 Bottom	Iowa River Downstream	University Water Plant
Apr. 26	82	62	56	69	57	88
May 3	10	30	33	50	34	29
10	38	13	14	15	12	16
16	60	18	13	15	12	20
24	45	35	46	57	28	28
June 1	65	22	30	40	17	21
8	60	15	50	140	25	25
14	750	34	40	66	22	20
21	120	58	60	81	80	90
28	78	20	33	80	22	28
July 5	72	12	40	44	15	20
12	80	20	25	40	20	20
21	70	20	40	80	25	30
26	50	10	15	50	20	30
Aug. 9	50	15	20	35	20	25
23	30	10	20	60	15	25
Sep. 13	25	15	15	30	20	15
27	27	10	12	20	17	15

SPECIFIC CONDUCTANCE
μmho/cm

Table 4

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River Downstream	University Water Plant
Oct. 6	576	536	555	555	527	555
13	537	479	479	479	447	479
19	706	606	606	606	585	606
27	543	471	487	487	471	505
Nov. 4	648	536	598	598	555	576
10	628	547	547	547	547	606
17	559	516	516	516	479	507
24	586	500	500	500	471	480
Dec. 1	381	421	421	421	480	471
8	650	560	560	560	570	580
15	740	576	576	576	622	648
22	737	565	565	595	547	606
Jan. 5	799	612	656	706	706	735
12	899	674	690	761	742	724
19	807	538	706	585	706	754
26	818	777	818	840	758	740
Feb. 2	676	706	723	740	676	740
9	706	725	725	744	764	764
16	565	530	547	547	737	706
23	681	625	625	625	625	636
Mar. 1	341	333	330	326	326	366
8	495	443	---	---	371	371
15	331	409	404	389	444	501
22	576	527	527	527	501	501
30	757	757	757	757	757	731
Apr. 5	740	723	723	723	706	706
12	679	706	736	736	736	768
19	609	706	654	631	785	801

Table 4 (continued)

Date 1975-1976	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2			Iowa River Downstream	University Water Plant
		Top	Mid-Depth	Bottom		
Apr. 26	436	476	476	476	476	500
May 3	493	450	464	457	420	420
10	---	---	---	---	---	---
16	610	648	634	648	622	622
24	677	677	677	663	663	650
June 1	497	671	671	671	671	655
8	614	744	623	543	642	565
14	642	785	785	785	744	744
21	636	397	424	397	363	353
28	731	785	815	848	883	757
July 5	577	692	692	710	769	729
12	509	669	652	636	636	636
21	463	639	639	610	655	610
26	420	610	584	610	639	639
Aug. 9	505	505	487	505	565	565
23	439	398	410	424	424	439
Sep. 13	556	484	491	499	484	478
27	471	435	435	446	414	414

TOTAL SOLIDS
(mg/l)

Table 5

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River Downstream	University Water Plant
Oct. 13	394	284	286	308	282	306
27	370	310	326	314	280	296
Nov. 10	398	296	296	322	276	316
24	364	308	320	316	276	326
Dec. 8	440	328	322	322	312	320
22	438	302	334	332	304	304
Jan. 5	468	340	360	442	398	378
19	396	392	522	432	388	396
Feb. 2	440	482	490	508	426	454
16	380	278	304	318	404	404
Mar. 1	898	850	846	844	832	818
15	874	822	838	868	792	306
30	636	714	698	770	450	418
Apr. 12	410	396	388	490	384	372
26	384	320	286	318	290	396
May 3	556	390	468	466	384	376
24	528	429	413	408	386	397
June 14	2,429	509	529	601	459	499
28	639	393	394	501	360	352
July 12	567	423	461	512	442	450
26	432	361	391	403	451	280
Aug. 9	388	297	268	343	370	380
23	360	272	301	362	311	335
Sep. 13	400	295	303	365	304	303
27	411	307	314	329	302	297

TOTAL SUSPENDED SOLIDS
(mg/l)

Table 6

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2			Iowa River Downstream	University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 13	313	259	260	277	257	267
27	332	282	300	288	263	219
Nov. 10	332	275	280	277	256	278
24	343	292	301	303	263	283
Dec. 8	64	16	19	17	7	12
22	13	13	10	9	11	14
Jan. 5	4	10	10	8	6	2
19	17	20	20	28	18	16
Feb. 2	6	4	5	4	3	4
16	20	20	40	38	24	64
Mar. 1	736	628	580	668	620	604
15	676	642	594	686	584	120
30	306	346	332	382	106	86
Apr. 12	36	28	26	40	18	22
26	168	108	92	112	94	98
May 3	16	12	24	90	36	116
24	175	69	94	91	49	42
June 14	209	78	98	186	38	78
28	202	43	65	130	35	102
July 12	256	40	50	87	46	62
26	180	24	28	86	36	58
Aug. 9	116	24	40	82	32	42
23	48	13	25	57	18	27
Sep. 13	116	38	32	100	24	28
27	94	22	30	38	34	30

TOTAL DISSOLVED SOLIDS
(mg/l)

Table 7

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Coralville Reservoir No. 2 Mid-Depth	Coralville Reservoir No. 2 Bottom	Iowa River Downstream	University Water Plant
Oct. 13	81	25	26	31	25	31
27	38	28	26	26	17	77
Nov. 10	66	21	16	45	20	38
24	21	16	19	13	13	43
Dec. 8	376	312	303	305	305	308
22	425	289	324	323	293	290
Jan. 5	464	330	360	434	392	376
19	299	372	502	404	370	380
Feb. 2	434	478	485	504	423	450
16	360	258	264	280	380	340
Mar. 1	162	222	266	176	212	214
15	198	180	244	182	208	186
30	330	368	366	388	344	332
Apr. 12	374	368	362	450	366	350
26	216	212	194	206	196	198
May 3	540	378	444	376	348	260
24	353	360	319	317	337	355
June 14	2,220	431	431	415	421	421
28	437	350	329	371	325	250
July 12	311	383	411	425	396	388
26	252	337	363	317	415	222
Aug. 9	272	273	228	261	338	338
23	312	259	276	305	293	308
Sep. 13	284	257	271	265	280	275
27	317	285	284	291	268	267

DISSOLVED OXYGEN
(mg/1)

Table 8

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2			Iowa River Downstream	University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 6	7.8	8.2	8.0	7.6	8.6	8.7
13	7.0	8.4	8.3	8.2	8.5	8.7
19	10.2	11.7	10.0	8.5	10.1	10.3
27	9.8	8.9	8.9	8.6	8.8	9.1
Nov. 4	7.8	14.0	9.1	8.2	9.7	9.8
10	10.0	9.0	8.8	9.1	9.6	9.2
17	12.8	10.4	9.8	9.8	10.5	10.2
24	12.1	10.5	10.5	6.5	11.1	8.6
Dec. 1	9.0	12.0	11.9	11.9	12.8	12.3
8	11.9	15.0	14.9	13.7	12.8	12.7
15	11.2	11.9	12.4	12.0	12.8	12.4
22	12.1	16.0	16.2	13.9	14.6	13.9
Jan. 5	13.5	31.8	24.5	21.2	13.2	14.0
12	10.6	28.5	19.5	15.8	13.1	13.1
19	9.8	20.0	15.5	13.5	11.5	11.2
26	11.2	23.0	16.6	15.1	12.9	12.7
Feb. 2	13.0	18.5	17.5	14.6	13.0	11.9
9	14.0	13.7	13.7	13.5	13.3	12.5
16	11.1	9.4	9.6	8.9	11.7	9.0
23	13.6	11.5	10.8	10.8	12.1	13.4
Mar. 1	9.0	9.5	9.0	8.9	11.2	10.2
8	11.4	11.6	---	---	13.6	14.5
15	15.0	14.6	14.5	14.5	15.5	14.3
22	12.5	11.8	11.4	11.0	13.7	13.6
30	11.1	11.4	11.5	10.6	12.9	12.5
Apr. 5	11.7	10.8	11.2	11.1	13.1	13.1
12	11.6	11.5	11.0	11.0	11.8	11.5
19	9.0	9.0	9.4	8.0	9.5	11.0

Table 8 (continued)

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River Downstream	University Water Plant
Apr. 26	8.8	9.8	10.6	10.7	11.5	7.6
May 3	11.5	11.2	11.0	11.3	14.5	14.3
10	14.3	12.5	12.1	12.6	14.5	13.5
16	10.8	13.1	12.3	11.9	14.2	13.5
24	8.1	7.7	6.5	7.2	8.5	7.7
June 1	7.0	8.2	7.8	7.7	9.5	8.9
8	8.6	8.9	5.4	6.5	9.9	9.7
14	8.5	8.8	8.2	8.0	9.6	9.2
21	8.2	8.0	8.0	7.9	7.8	8.7
28	8.1	7.9	8.2	8.1	8.2	8.7
July 5	8.0	10.7	2.2	2.0	8.8	7.0
12	10.5	6.3	0.8	0.3	7.4	6.6
21	8.4	6.2	4.3	3.8	7.1	6.0
26	7.9	8.6	4.2	0.9	7.5	6.6
Aug. 9	5.4	6.1	4.2	3.0	7.0	6.7
23	5.5	11.1	1.6	0.7	7.6	7.6
Sep. 13	6.9	6.9	6.9	5.0	7.5	8.7
27	8.1	6.9	6.8	6.6	8.1	8.1

CARBON DIOXIDE
as $CaCO_3$ (mg/l)

Table 9

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Coralville Reservoir No. 2 Mid-Depth	Coralville Reservoir No. 2 Bottom	Iowa River Downstream	University Water Plant
Oct. 13	3.5	0	0	0	3.5	3.5
27	0	0	0	0	0	0
Nov. 10	0	0	0	0	0	0
24	0	0	0	0	0	0
Dec. 8	0	0	0	0	0	0
22	7.0	0	0	0	0	0
Jan. 5	5.3	0	0	0	0	0
19	7.0	0	0	3.5	3.5	0
Feb. 2	7.0	5.3	7.0	8.8	7.0	5.3
16	3.5	5.3	7.0	7.0	8.8	7.0
Mar. 1	3.5	3.5	3.5	3.5	3.5	3.5
15	3.5	3.5	3.5	3.5	3.5	3.5
30	3.5	3.5	5.3	7.0	5.3	3.5
Apr. 12	0	0	0	0	0	3.5
26	5.3	5.3	5.3	5.3	5.3	5.3
May 3	0	0	0	0	0	3.5
24	0	0	0	0	0	0
June 14	2.4	0	0	0	0	0
28	0	0	4.0	6.0	6.0	6.0
July 12	0	0	1.0	1.2	0	0
26	0	0	4.0	12.0	5.0	6.0
Aug. 9	9.1	6.8	11.4	11.4	6.8	6.8
23	6.0	0	9.0	12.0	4.0	2.0
Sep. 13	12.0	10.0	10.0	12.0	10.0	2.0
27	6.0	6.0	6.0	6.0	6.0	4.0

ALKALINITY as $CaCO_3$
Phenolphthalein (mg/l)

Table 10

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Coralville Reservoir No. 2 Mid-Depth	Coralville Reservoir No. 2 Bottom	Iowa River Downstream	University Water Plant
Oct. 13	0	4	4	4	0	0
27	6	10	10	10	6	4
Nov. 10	8	10	10	8	6	4
24	12	6	8	8	6	6
Dec. 8	4	12	14	12	6	8
22	0	12	10	6	6	8
Jan. 5	0	18	16	10	8	6
19	0	16	2	0	0	2
Feb. 2	0	0	0	0	0	0
16	0	0	0	0	0	0
Mar. 1	0	0	0	0	0	0
15	0	0	0	0	0	0
30	0	0	0	0	0	0
Apr. 12	7.2	5.3	5.3	5.3	3.6	0
26	0	0	0	0	0	0
May 3	9.0	7.2	5.4	5.4	3.6	0
26	6.0	4.0	4.0	4.0	4.0	4.0
June 14	0	8.0	8.0	6.0	6.0	8.0
28	2.0	4.0	0	0	0	0
July 12	10.0	6.0	0	0	6.0	6.0
26	2.0	8.0	0	0	0	0
Aug. 9	0	0	0	0	0	0
23	0	14	0	0	0	0
Sep. 13	0	0	0	0	0	0
27	0	0	0	0	0	0

ALKALINITY as $CaCO_3$
Total (mg/l)

Table 11

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2			Iowa River Downstream	University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 13	186	170	170	170	162	170
27	224	186	186	184	162	196
Nov. 10	228	166	164	164	162	162
24	226	192	194	194	176	184
Dec. 8	228	200	200	228	192	196
22	270	198	192	202	176	184
Jan. 5	270	178	200	228	220	220
19	290	240	246	270	236	234
Feb. 2	270	270	288	292	248	258
16	166	167	173	180	221	230
Mar. 1	95	95	86	90	90	99
15	97	108	104	108	122	157
30	196	193	193	194	187	187
Apr. 12	212	205	212	212	203	194
26	103	108	108	113	113	113
May 3	166	160	157	162	147	151
24	226	204	210	210	204	214
June 14	190	232	234	222	216	214
28	238	208	212	218	188	186
July 12	160	210	210	210	180	182
26	124	200	200	240	230	222
Aug. 9	150	156	152	148	180	188
23	120	190	110	100	176	176
Sep. 13	196	172	172	174	176	162
27	202	186	196	192	172	168

HARDNESS as $CaCO_3$
Calcium (mg/l)

Table 12

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Coralville Reservoir No. 2 Mid-Depth	Coralville Reservoir No. 2 Bottom	Iowa River Downstream	University Water Plant
Oct. 13	144	132	124	124	124	128
27	164	132	132	132	124	124
Nov. 10	164	128	124	128	128	128
24	176	144	152	168	164	156
Dec. 8	192	152	144	148	156	148
22	272	164	172	192	188	164
Jan. 5	220	140	156	176	176	180
19	252	216	232	236	236	252
Feb. 2	294	280	290	268	246	242
16	224	262	318	312	400	416
Mar. 1	154	122	134	184	108	132
15	144	136	130	128	132	134
30	256	294	276	282	280	294
Apr. 12	218	222	224	212	216	206
26	142	134	132	126	128	130
May 3	214	270	295	276	284	260
24	286	220	276	224	208	210
June 14	234	266	272	244	228	188
28	228	196	180	184	164	168
July 12	120	180	184	184	172	164
26	100	168	76	156	196	192
Aug. 9	112	196	128	124	164	144
23	112	120	116	112	116	128
Sep. 13	148	116	120	116	116	120
27	192	164	156	148	140	132

HARDNESS as $CaCO_3$
Total (mg/l)

Table 13

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Coralville Reservoir No. 2 Mid-Depth	Coralville Reservoir No. 2 Bottom	Iowa River Downstream	University Water Plant
Oct. 13	244	224	220	220	208	216
27	304	240	236	236	216	228
Nov. 10	300	232	232	280	216	220
24	280	308	292	232	260	260
Dec. 8	312	248	236	260	252	288
22	356	296	244	240	232	232
Jan. 5	292	256	280	276	288	280
19	432	332	380	388	332	344
Feb. 2	332	360	368	368	286	292
16	260	296	344	338	422	456
Mar. 1	184	170	174	196	204	204
15	178	168	166	162	174	166
30	322	322	336	322	334	322
Apr. 12	284	278	282	276	274	268
26	168	170	168	162	172	166
May 3	254	292	318	308	310	286
24	308	240	284	244	248	252
June 14	254	298	288	272	256	218
28	280	264	284	280	240	228
July 12	224	268	284	236	248	228
26	216	296	268	308	280	328
Aug. 9	220	212	208	252	256	264
23	208	208	200	220	212	236
Sep. 13	252	216	220	224	212	212
27	252	240	232	228	208	220

pH

Table 14

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2			Iowa River Downstream	University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 6	8.2	8.2	8.2	8.1	8.0	7.9
13	8.1	8.4	8.4	8.4	8.1	8.1
19	8.2	8.6	8.6	8.4	8.3	8.3
27	8.5	8.7	8.7	8.7	8.6	8.4
Nov. 4	8.6	9.3	8.8	8.6	8.6	8.5
10	8.6	8.7	8.7	8.6	8.4	8.3
17	8.7	8.6	8.6	8.5	8.5	8.3
24	8.7	8.5	8.5	8.5	8.5	8.5
Dec. 1	8.4	8.6	8.5	8.4	8.3	8.1
8	8.3	8.8	8.8	8.7	8.6	8.5
15	8.2	8.4	8.4	8.5	8.5	8.5
22	8.0	8.6	8.6	8.4	8.4	8.5
Jan. 5	8.1	9.0	8.9	8.7	8.5	8.4
12	7.6	8.5	8.3	8.0	8.0	8.1
19	7.8	8.7	8.3	8.1	8.1	8.3
26	8.8	8.2	8.1	8.0	8.0	8.0
Feb. 2	7.8	7.9	7.9	7.8	7.9	8.0
9	7.7	7.7	7.7	7.7	7.7	7.9
16	8.0	7.8	7.6	7.6	7.6	7.6
23	8.1	8.1	8.0	8.0	7.9	8.0
Mar. 1	8.0	8.0	8.0	8.0	7.9	8.0
8	8.1	8.1	---	---	8.1	8.1
15	8.1	8.1	8.1	8.1	8.1	8.1
22	7.9	7.9	7.9	7.9	7.9	7.9
30	8.1	8.1	8.1	8.0	8.1	8.1
Apr. 5	8.0	8.0	8.0	8.0	8.0	8.0
12	8.3	8.3	8.3	8.3	8.3	8.2
19	8.0	8.0	7.9	7.9	7.9	7.9

Table 14 (continued)

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2			Iowa River Downstream	University Water Plant
		Top	Mid-Depth	Bottom		
Apr. 26	7.7	7.7	7.8	7.8	7.8	7.7
May 3	8.0	8.0	8.0	8.0	8.0	8.0
10	8.6	8.4	8.3	8.3	8.3	8.2
16	8.1	8.4	8.3	8.3	8.4	8.4
24	8.3	8.3	8.3	8.2	8.3	8.3
June 1	7.7	8.2	8.3	8.3	8.3	8.3
8	8.4	8.5	8.1	8.0	8.3	8.3
14	8.0	8.3	8.3	8.3	8.4	8.4
21	8.2	8.0	8.0	7.9	7.8	7.8
28	8.3	8.3	8.1	8.0	8.0	8.0
July 5	8.2	8.4	7.5	7.5	8.1	8.3
12	8.7	8.5	8.1	8.0	8.5	8.5
21	8.6	8.3	7.9	7.9	8.3	8.1
26	8.4	8.6	7.9	7.6	8.1	8.1
Aug. 9	7.5	7.7	7.5	7.4	7.9	8.0
23	7.5	8.7	7.5	7.3	7.9	8.1
Sep. 13	8.0	8.1	8.1	7.9	8.0	8.3
27	8.0	8.0	8.0	8.0	8.0	8.1

ORTHOPHOSPHATE
(mg/1)

Table 15

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Coralville Reservoir No. 2 Mid-Depth	Coralville Reservoir No. 2 Bottom	Iowa River Downstream	University Water Plant
Oct. 13	0.15	0.17	0.15	0.27	0.32	0.37
27	0.06	0.065	0.06	0.055	0.06	0.092
Nov. 10	0.09	0.04	0.07	0.06	0.05	0.06
24	0.08	0.02	0.09	0.07	0.06	0.06
Dec. 8	0.25	0.02	0.02	0.02	0.02	0.04
22	0.26	0.03	0.03	0.03	0.04	0.07
Jan. 5	0.15	0.03	0.03	0.03	0.13	0.10
19	0.23	0.13	0.06	0.06	0.04	0.03
Feb. 2	0.21	0.04	0.03	0.03	0.05	0.10
16	0.18	0.05	0.06	0.06	0.06	0.07
Mar. 1	0.09	0.03	0.05	0.05	0.05	0.06
15	0.37	0.51	0.28	0.32	0.23	0.17
30	0.08	0.04	0.05	0.05	0.05	0.04
Apr. 12	0.17	0.10	0.11	0.17	0.10	0.10
26	0.08	0.07	0.07	0.07	0.05	0.13
May 3	0.12	0.10	0.10	0.11	0.09	0.10
24	0.16	0.13	0.14	0.15	0.10	0.10
June 14	0.28	0.17	0.09	0.15	0.22	0.10
28	0.18	0.12	0.12	0.13	0.11	0.11
July 12	0.5	0.15	0.21	0.14	0.36	0.18
26	0.09	0.08	0.09	0.12	0.09	0.08
Aug. 9	0.06	0.08	0.12	0.09	0.09	0.12
23	0.11	0.01	0.06	0.09	0.03	0.06
Sep. 13	0.09	0.03	0.03	0.06	0.06	0.03
27	0.04	0.02	0.03	0.04	0.04	0.03

NITROGEN
Ammonia as N (mg/l)

Table 16

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Coralville Reservoir No. 2 Mid-Depth	Coralville Reservoir No. 2 Bottom	Iowa River Downstream	University Water Plant
Oct. 13	0.15	0.14	0.08	0.08	0.02	0.01
27	0.06	0.14	0.07	0.15	0.14	0.02
Nov. 10	0.20	0.13	0.18	0.14	0.13	0.14
24	T	0.12	0.16	0.14	0.15	0.07
Dec. 8	0.80	0.08	0.34	0.20	0.22	0.40
22	0.68	0.32	0.26	0.30	0.20	0.22
Jan. 5	0.40	0.18	0.22	0.20	0.34	0.28
19	0.18	0.42	0.58	0.52	0.70	0.36
Feb. 2	0.26	0.17	0.14	0.21	0.26	0.25
16	0.22	0.56	0.55	0.66	0.33	0.39
Mar. 1	0.84	1.09	1.02	1.05	1.18	1.15
15	0.21	0.42	0.45	0.50	0.58	0.25
30	0.13	0.30	0.25	0.30	0.37	0.43
Apr. 12	<0.01	<0.01	<0.01	0.04	0.08	0.13
26	0.20	0.28	0.26	0.22	0.30	0.38
May 3	0.20	0.12	0.07	0.07	0.10	0.22
24	0.03	0.12	0.10	0.10	0.13	0.19
June 14	0.18	0.13	0.16	0.10	0.12	0.17
28	0.02	0.04	0.02	0.02	0.02	0.01
July 12	0.32	0.14	0.30	0.14	0.18	0.38
26	0.32	0.16	0.14	0.16	0.16	0.16
Aug. 9	0.12	0.20	0.26	0.46	0.30	0.08
23	0.07	0.18	0.51	0.47	0.12	0.15
Sep. 13	0.20	0.10	0.23	0.31	0.24	0.18
27	0.08	0.21	0.27	0.38	0.22	0.32

NITROGEN
Nitrate as N (mg/l)

Table 17

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2			Iowa River Downstream	University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 13	0.09	0.25	0.31	0.36	1.70	0.62
27	0.05	0.01	0.11	0.10	0.06	0.58
Nov. 10	0.14	0.12	0.04	0.06	0.10	0.17
24	0.12	0.11	0.05	0.07	0.14	0.18
Dec. 8	3.85	0.04	0.08	0.09	0.07	0.14
22	0.11	0.06	0.05	0.04	0.19	0.60
Jan. 5	1.70	1.30	1.10	1.30	1.50	0.80
19	2.26	1.42	2.04	2.26	1.80	1.80
Feb. 2	2.46	2.30	2.33	2.09	2.27	2.27
16	7.00	7.80	5.50	7.50	7.00	8.00
Mar. 1	5.85	5.66	5.85	6.86	4.99	5.21
15	4.11	4.46	4.43	5.24	4.11	3.68
30	3.80	4.50	4.20	4.60	4.80	5.20
Apr. 12	4.50	4.80	4.90	4.90	5.10	4.90
26	5.90	5.60	6.10	5.80	5.60	6.30
May 3	6.6	7.2	2.7	6.7	8.0	8.4
24	7.9	6.6	6.5	6.8	7.4	6.2
June 14	8.0	7.9	8.0	9.5	7.9	7.9
28	7.2	7.2	7.2	7.2	6.8	7.6
July 12	2.7	5.4	5.2	4.8	6.5	5.4
26	4.5	4.5	0.5	2.6	2.4	1.9
Aug. 9	0.26	0.60	0.26	0.32	2.30	2.60
23	0.23	0.13	0.17	0.36	2.40	1.20
Sep. 13	0.20	0.13	0.10	0.24	0.13	0.13
27	0.27	0.13	0.13	0.19	0.27	0.19

5-DAY, $20^{o}C$
BIOCHEMICAL OXYGEN DEMAND
(mg/1)

Table 18

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2			Iowa River Downstream	University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 13	6.0	3.0	4.0	4.0	3.0	4.0
27	7.0	5.0	4.0	4.0	4.0	3.0
Nov. 10	3.8	3.0	3.6	3.6	2.2	1.8
24	5.6	3.8	4.0	3.6	3.6	4.0
Dec. 8	5.8	3.6	4.0	3.6	3.4	3.8
22	1.6	3.0	2.0	2.0	3.0	3.0
Jan. 5	2.6	5.6	4.6	4.4	3.0	4.0
19	3.3	6.6	4.5	3.6	3.9	3.6
Feb. 2	3.0	5.0	4.4	4.4	4.0	3.4
16	2.8	6.2	4.6	3.6	3.6	3.4
Mar. 1	10.1	6.9	4.5	5.7	3.9	4.8
15	11.6	6.8	6.4	9.0	4.4	5.4
30	3.9	4.5	5.7	5.7	5.4	5.4
Apr. 12	10.5	6.6	6.9	8.4	5.1	4.2
26	3.0	5.7	4.8	3.6	4.2	3.3
May 3	4.8	1.5	2.1	1.5	2.7	1.5
24	1.8	2.8	3.0	2.6	3.0	7.4
June 14	6.4	2.8	3.4	4.2	2.2	3.2
28	3.6	3.4	5.0	4.0	4.8	2.8
July 12	9.4	2.2	2.0	2.2	1.2	1.6
26	---	---	---	---	---	---
Aug. 9	8.6	2.8	2.8	3.4	2.2	2.1
23	4.0	4.6	4.3	4.6	6.0	4.8
Sep. 13	5.6	3.5	4.0	3.7	2.2	3.3
27	6.1	2.5	2.4	2.8	2.2	1.8

THRESHOLD ODOR NUMBER

Table 19

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2			Iowa River Downstream	University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 13	7.5	7.5	13	5.6	7.5	7.5
27	10	10	10	13	13	10
Nov. 10	7.5	13	5.6	10	10	7.5
24	7.5	7.5	10	10	13	10
Dec. 8	5.6	10	10	10	10	10
22	10	10	10	13	13	13
Jan. 5	7.5	10	13	18	13	18
19	5.6	5.6	7.5	7.5	10	5.6
Feb. 2	7.5	13	13	10	13	7.5
16	10	13	13	13	10	10
Mar. 1	10	10	13	13	13	13
15	7.5	13	13	18	18	18
30	7.5	10	13	13	5.6	10
Apr. 12	13	18	13	7.5	10	10
26	13	13	18	18	10	13
May 3	7.5	10	10	10	7.5	10
24	10	18	13	10	13	10
June 14	13	13	13	13	18	13
28	13	10	10	13	7.5	7.5
July 12	24	10	10	10	13	10
26	18	8	18	24	18	6
Aug. 9	32	24	18	18	7.5	13
23	32	18	14	14	10	10
Sep. 13	18	13	13	18	18	42
27	18	13	13	18	18	32

TOTAL COLIFORM BACTERIA
(Number of coliform bacteria per 100 ml)

Table 20

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Coralville Reservoir No. 2 Mid-Depth	Coralville Reservoir No. 2 Bottom	Iowa River Downstream	University Water Plant
Oct. 13	500	<100	<100	<100	300	200
27	300	<100	<100	<100	<100	200
Nov. 10	<1,000	<1,000	<1,000	<1,000	<1,000	5,000
24	<100	<100	<100	<100	<100	200
Dec. 8	700	<100	100	100	100	200
22	200	100	100	200	<100	<100
Jan. 5	200	<100	<100	100	<100	<100
19	200	<100	<100	<100	<100	<100
Feb. 2	100	<100	<100	<100	<100	100
16	600	200	300	400	<100	2,800
Mar. 1	5,000	2,600	2,300	2,400	7,500	41,000
15	36,000	93,000	117,000	127,000	54,000	25,000
30	5,200	3,000	2,100	3,000	2,400	1,600
Apr. 12	900	500	800	300	800	600
26	7,000	4,000	3,000	15,000	2,000	19,000
May 3	100	100	2,100	100	100	200
24	1,600	300	800	400	400	100
June 14	72,000	100	<100	200	600	1,100
28	1,500	300	400	900	400	1,100
July 12	400	<100	<100	100	<100	300
26	<100	<100	3,000	<100	100	<100
Aug. 9	600	<100	<100	<100	1,100	300
23	<100	<100	<100	<100	200	800
Sep. 13	53,000	2,100	1,300	3,800	4,600	1,100
27	6,900	2,200	2,500	3,100	7.900	4,300

FECAL COLIFORM BACTERIA
(Number of coliform bacteria per 100 ml)

Table 21

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Coralville Reservoir No. 2 Mid-Depth	Coralville Reservoir No. 2 Bottom	Iowa River Downstream	University Water Plant
Oct. 13	400	<10	<10	<10	40	130
27	260	<10	<10	<10	20	170
Nov. 10	200	<100	<100	<100	<100	400
24	<10	<10	<10	<10	10	90
Dec. 8	600	20	70	90	60	110
22	70	10	10	10	<10	20
Jan. 5	90	<10	10	10	<10	<10
19	120	<10	<10	<10	<10	<10
Feb. 2	20	<10	<10	<10	<10	10
16	120	60	30	20	<10	140
Mar. 1	530	480	1,050	790	450	380
15	4,800	1,200	2,200	3,000	600	100
30	1,210	150	70	90	100	140
Apr. 12	10	10	20	30	10	30
26	2,000	2,100	1,400	2,000	700	6,300
May 3	<100	<100	300	100	<100	<100
24	250	60	50	50	10	20
June 14	22,300	20	<10	10	40	410
28	440	30	60	250	70	220
July 12	160	<10	<10	10	20	40
26	20	<10	<10	<10	10	<10
Aug. 9	90	<10	10	10	<10	60
23	50	<10	30	10	30	280
Sep. 13	140	10	<10	<10	360	40
27	150	20	10	10	140	170

FECAL STREPTOCOCCI
(Number of organisms per 100 ml)

Table 22

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2 Top	Coralville Reservoir No. 2 Mid-Depth	Coralville Reservoir No. 2 Bottom	Iowa River Downstream	University Water Plant
Oct. 13	150	20	20	50	20	150
27	40	10	20	10	40	80
Nov. 10	250	70	40	40	<10	750
24	40	<10	<10	10	<10	40
Dec. 8	260	160	200	150	50	110
22	190	30	30	20	10	10
Jan. 5	70	10	<10	<10	<10	<10
19	300	<10	<10	<10	<10	10
Feb. 2	30	<10	<10	<10	<10	<10
16	270	40	100	40	<10	180
Mar. 1	2,700	3,200	2,800	4,200	2,900	2,800
15	4,900	7,000	9,700	9,100	3,800	600
30	270	150	200	310	110	210
Apr. 12	60	<10	20	80	20	20
26	1,600	600	900	1,400	1,100	2,100
May 3	60	20	150	10	10	20
24	100	50	40	40	<10	50
June 14	7,400	<10	<10	10	20	710
28	290	20	60	290	50	360
July 12	390	30	20	10	<10	100
26	390	<10	<10	<10	20	30
Aug. 9	80	20	<10	<10	310	210
23	320	<10	<10	<10	20	230
Sep. 13	280	<10	<10	10	1,220	80
27	170	<10	<10	<10	20	150

TOTAL PLANKTON ORGANISMS
(Organisms per ml)

Table 23

Date 1975-76	Highway "O" Iowa River Upstream	Coralville Reservoir No. 2				Iowa River Downstream	University Water Plant
		Top	Mid-Depth	Bottom	Mean		
Oct. 13	58,370	12,990	15,200	15,850	14,680	2,500	4,800
Nov. 10	79,940	10,560	10,660	9,760	10,330	10,340	9,600
Dec. 8	9,740	19,230	30,050	21,220	23,500	9,700	10,980
Jan. 5	2,030	20,260	32,640	26,690	26,530	20,860	25,280
Feb. 16	5,060	4,420	2,180	2,860	3,150	7,730	10,430
Mar. 15	5,600	5,440	6,560	6,890	6,300	4,480	4,800
Apr. 12	19,200	18,500	28,930	18,240	21,890	12,160	6,910
May 10	22,976	6,080	6,976	6,080	6,378	6,272	3,264
June 14	4,640	2,861	3,456	2,784	3,033	8,877	5,830
July 26	55,456	14,837	8,933	4,989	9,586	6,236	9,266
Aug. 9	35,294	11,939	10,512	6,236	9,562	5,701	11,584
Sep. 13	28,964	12,562	17,909	10,067	13,513	7,306	22,092

Table 24

SUMMARY OF SEDIMENT ANALYSIS
(Reported as μg/gm dry weight)

Location	Copper	Chromium	Lead	Zinc
February 2, 1976				
Iowa River U/S (Rd. 0)	10.0	16.0	28.0	41.6
Coralville Reservoir	20.0	26.0	72.0	80.0
Iowa River D/S (Hw 218)	8.0	12.0	24.0	22.8
Iowa River D/S (Water Plant)	10.0	22.0	112.0	36.8
May 10, 1976				
Iowa River U/S (Rd. 0)	16.0	20.0	432.0	70.0
Coralville Reservoir	28.0	34.0	64.0	102.0
Iowa River D/S (Hy 218)	6.0	8.0	16.0	12.0
Iowa River D/S (Water Plant)	10.0	16.0	52.0	47.0
July 26, 1976				
Iowa River (Rd. 0)	20.0	20.0	40.0	61.6
Coralville Reservoir	26.0	22.0	60.0	93.2
Iowa River D/S (Hy 218)	26.0	8.0	16.0	19.2
Iowa River D/S (Water Plant)	16.0	14.0	40.0	37.6

Table 25

MONTHLY MEAN FLOWS (in cfs) FOR IOWA RIVER AT MARENGO
OCTOBER 1970 - SEPTEMBER 1976

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Mean for Water Year
1976	245	308	400	184	632	2097	4572	2489	2193	632	278	133	1181
1975	734	1884	1538	1475	760	5403	4231	2662	4530	1684	583	447	2164
1974	1966	1177	1396	1913	3118	3523	2957	8220	7635	2153	3574	767	3201
1973	2468	3878	1868	4194	4363	6269	8197	5835	4968	1843	834	701	3773
1972	165	365	515	279	361	2183	1196	2225	4984	2160	3768	1439	1640
1971	2222	1648	1195	636	3214	5493	2314	1446	1389	1422	375	204	1792
1970	587	660	336	257	685	2438	1552	3508	1567	562	1135	1031	1201
1969	631	479	516	837	648	5217	4643	2725	4469	11340	2453	783	2917
1968	203	286	205	214	252	358	920	588	460	1286	859	295	495
1967	193	175	144	267	343	525	537	354	3137	1046	523	230	621
10 Year Average	941	1086	811	1025	1438	3380	3112	3005	3533	2413	1438	603	1899

Table 26

COMPARISON OF AVERAGE MONTHLY VALUES FOR SELECTED PARAMETERS
DURING HIGH (1973), LOW (1976) AND AVERAGE (1971) FLOW WATER YEARS

Month & Year	Average U/S River Discharge cfs*	Orthophosphate mg/1		Ammonia-N mg/1		Turbidity NTU		Total Coliforms organisms/100 ml	
		U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S
Oct. 1972	2468	0.78	0.53	0.21	0.47	62	12	45,000	1,400
Oct. 1975	245	0.11	0.19	0.11	0.04	18	17	400	200
Oct. 1970	2222	0.65	0.44	0.35	0.23	143	20	29,000	1,300
Nov. 1972	3878	0.45	0.39	0.07	0.10	25	8	30,500	550
Nov. 1975	308	0.09	0.05	0.10	0.14	18	10	550	550
Nov. 1970	1648	0.50	0.33	0.31	0.28	45	10	40,600	960
Dec. 1972	1868	0.28	0.25	0.45	0.27	11	6	12,700	450
Dec. 1975	400	0.25	0.03	0.74	0.21	240	8	450	100
Dec. 1970	1195	0.23	0.19	0.16	0.14	14	5	540	130
Jan. 1973	4194	0.55	0.50	0.74	0.74	25	33	276,100	28,500
Jan. 1976	184	0.19	0.09	0.29	0.52	13	6	200	100
Jan. 1971	636	0.45	0.30	0.42	0.36	21	3	1,500	500
Feb. 1973	4362	0.55	0.38	0.68	0.75	48	150	5,900	5,050
Feb. 1976	632	0.19	0.05	0.24	0.29	16	8	350	100
Feb. 1971	3214	1.09	0.65	0.96	0.92	10	18	41,200	43,000
Mar. 1973	6269	1.38	1.11	0.99	1.60	48	47	650	350
Mar. 1976	2097	0.18	0.11	0.39	0.71	335	184	23,000	21,300
Mar. 1971	5493	0.58	0.56	1.33	1.09	122	64	33,800	8,200
Apr. 1973	8197	0.81	0.43	0.40	0.24	171	11	14,333	767
Apr. 1976	4572	0.13	0.07	0.10	0.19	249	43	3,900	1,400
Apr. 1971	2314	0.49	0.55	0.33	0.20	52	55	8,200	46,000
May 1973	5835	0.48	0.33	0.02	0.02	53	14	2,450	7,740
May 1976	2489	0.14	0.09	0.11	0.11	38	21	850	250
May 1971	1446	0.62	0.31	0.13	0.14	38	68	3,050	4,600

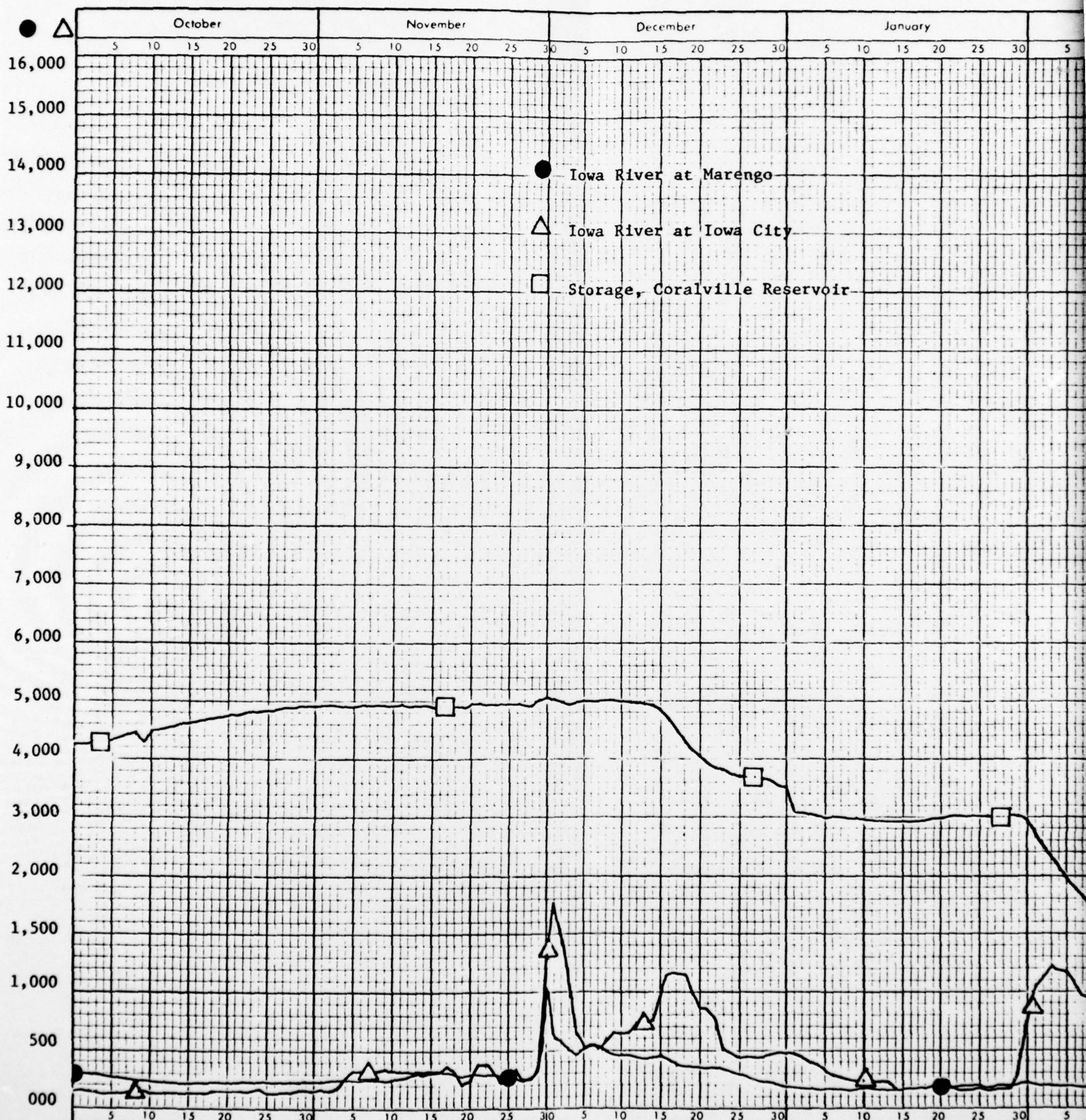
Table 26 (continued)

Month & Year	Average U/S River Discharge cfs*	Orthophosphate mg/1		Ammonia-N mg/1		Turbidity NTU		Total Coliforms organisms/100 ml	
		U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S
June 1973	4968	0.61	0.27	0.08	0.25	242	9	24,870	835
June 1976	2193	0.23	0.17	0.10	0.07	215	33	37,000	500
June 1971	1389	0.86	0.34	0.20	0.21	340	24	61,400	8,600
July 1973	1843	0.65	0.22	0.42	0.24	268	11	27,055	3,400
July 1976	632	0.29	0.23	0.32	0.17	68	20	250	100
July 1971	1442	0.42	0.51	0.43	0.21	310	62	10,000	3,000
Aug. 1973	834	0.28	0.28	0.34	0.68	61	17	23,485	4,960
Aug. 1976	278	0.09	0.06	0.09	0.21	40	17	350	650
Aug. 1971	375	0.35	0.28	0.36	0.24	51	14	11,500	5,100
Sep. 1973	701	0.74	0.21	0.75	0.83	32	15	28,375	9,805
Sep. 1976	133	0.07	0.05	0.14	0.23	26	19	30,000	6,250
Sep. 1971	204	0.19	0.50	0.18	0.27	28	12	17,000	37,000
1973 Average	3773	0.64	0.41	0.42	0.51	91	27	49,142	7,373
1976 Average	1181	0.16	0.10	0.23	0.26	114	37	7,800	3,370
1971 Average	1792	0.55	0.41	0.44	0.38	98	29	21,400	9,750

*Data from U.S. Geological Survey gauging station at Marengo, Iowa.

Table 27
COMPARISON OF AVERAGE MONTHLY CHEMICAL AND BIOLOGICAL PARAMETERS
IN THE IOWA RIVER ABOVE (A) AND BELOW (B) THE CORALVILLE RESERVOIR

Dates 1975-76	Orthophosphate mg/1		5-Day BOD mg/1		Coliforms per 100 ml		Total Plankton per ml		Threshold Odor No.		Turbidity J.T.U.		Ammonia mg/1	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
October	0.11	0.19	6.5	3.5	400	200	58,370	2,500	8.7	10.3	18	17	0.11	0.08
November	0.09	0.05	4.7	2.9	550	550	79,940	10,340	7.5	11.5	18	10	0.10	0.14
December	0.25	0.03	3.7	3.2	450	100	9,740	9,700	7.8	11.5	240	8	0.74	0.21
January	0.19	0.09	2.9	3.5	200	100	2,030	20,860	6.5	11.5	13	6	0.29	0.52
February	0.19	0.05	2.9	3.8	350	100	5,060	7,730	8.7	11.5	16	8	0.24	0.29
March	0.18	0.11	8.5	4.6	23,000	21,300	5,600	4,480	8.3	12.2	335	184	0.39	0.71
April	0.13	0.07	6.7	4.7	3,900	1,400	19,200	12,160	13.0	10.0	249	43	0.10	0.19
May	0.14	0.09	3.3	2.9	850	250	22,976	6,272	8.7	10.3	38	21	0.11	0.11
June	0.23	0.17	5.0	3.5	37,000	500	4,640	8,877	13.0	12.7	215	33	0.10	0.07
July	0.29	0.23	9.4	1.2	250	100	55,456	6,236	21.0	15.5	68	20	0.32	0.17
August	0.09	0.06	6.3	4.1	350	650	35,294	5,701	32.0	8.7	40	17	0.09	0.21
September	0.07	0.05	5.9	2.2	30,000	6,250	28,964	7,306	18.0	18.0	26	19	0.14	0.23
Average of all samples	0.16	0.10	5.5	3.5	7,800	3,370	27,270	8,514	12.6	12.0	114	37	0.23	0.26



Plotted by ______ Checked by ______ Date ______

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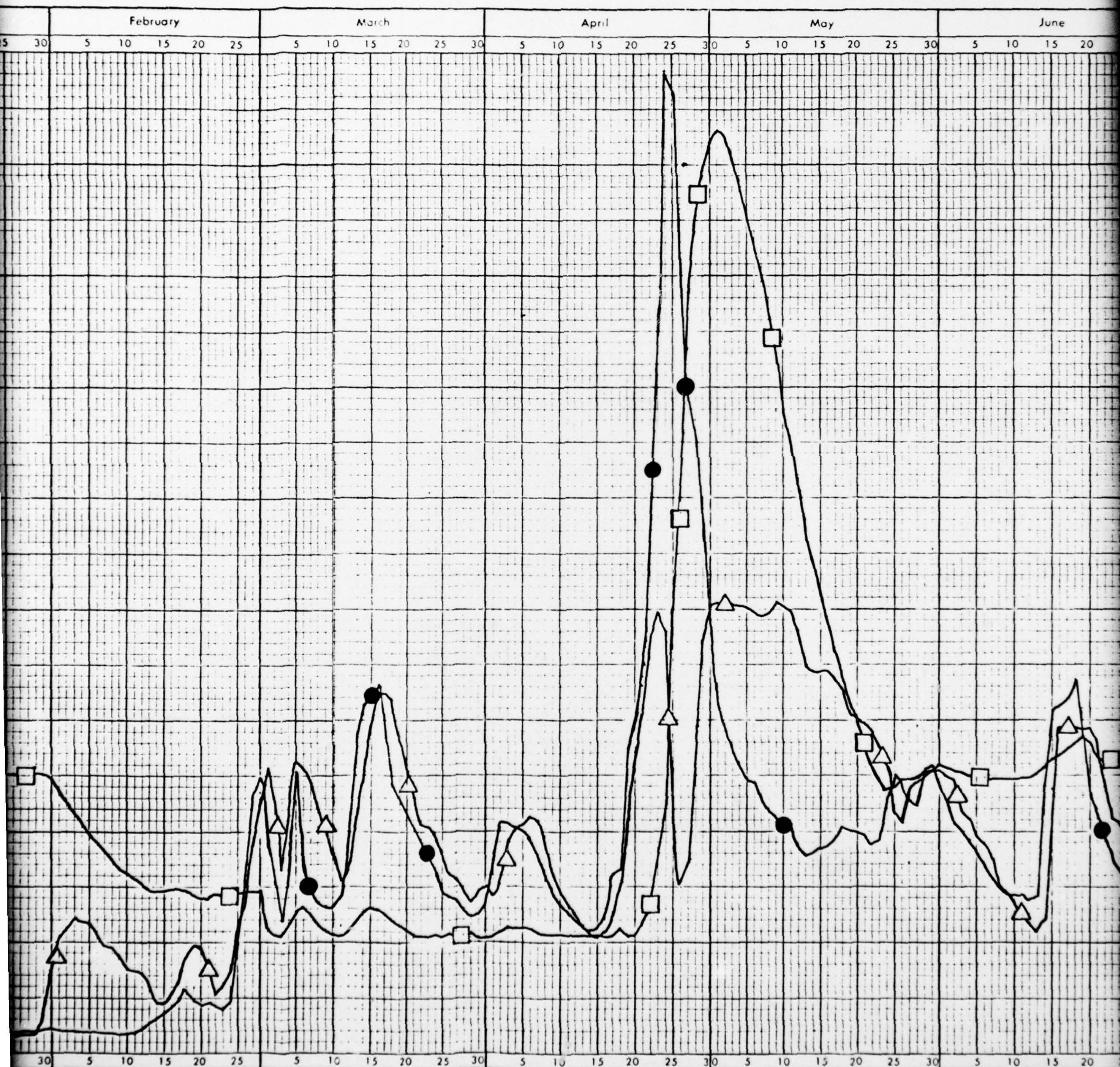
HYDROGRAPH FOR



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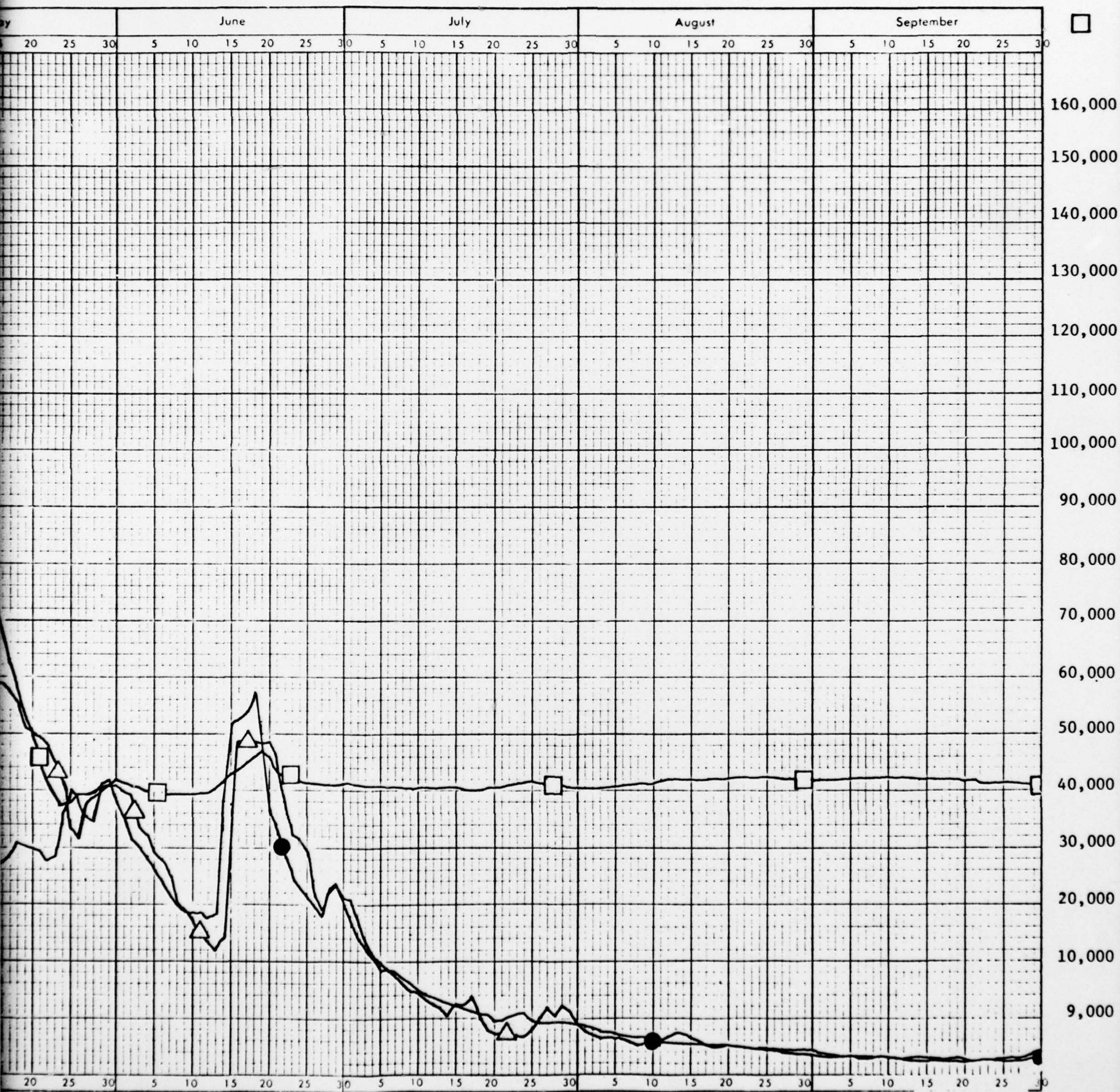

June
July
August
September
160,000
150,000
140,000
130,000
120,000
110,000
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
9,000

3